

Claims

What is claimed is:

- 5        1. A dielectric comprising a solid material including elements of barium, cadmium, and tantalum.
- 10      2. The dielectric of claim 1 wherein the cadmium and tantalum are combined in a predetermined ratio.
- 15      3. The dielectric of claim 2 wherein the predetermined ratio is one-third cadmium and two-thirds tantalum.
- 20      4. The dielectric of claim 2 wherein the cadmium and tantalum are combined over a range of values.
- 25      5. The dielectric of claim 1 wherein the solid material further includes an element with valence 2.
- 30      6. The dielectric of claim 5 wherein the element is selected from a group of zinc and magnesium.
7. The dielectric of claim 6 wherein the cadmium, zinc, and tantalum are combined in a predetermined ratio.
8. The dielectric of claim 1 wherein the material includes  $Ba_{1+y}(Cd_{x+a}M_{1/3-x}Ta_{2/3})O_{3+z}$  wherein  $-0.1 < a < 0.1$ ,  $0 < x < 0.333$ ,  $-0.1 < y < 0.1$  and  $-0.1 < z < 0.1$ .
9. The dielectric of claim 1 wherein the material includes  $Ba_{1+y}(Cd_{1/3+a}Ta_{2/3})O_{3+z}$ , wherein  $-0.1 < a < 0.1$ ,  $0 < x < 0.333$ ,  $-0.1 < y < 0.1$  and  $-0.1 < z < 0.1$ .

10. An electronic device, comprising:

a region providing an electrical function, wherein the region includes a solid material having at least elements of barium, cadmium, and tantalum; and

5 an electrical terminal connected to the region.

11. The electronic device of claim 10 where the region provides a resonator electrical function.

10 12. The electronic device of claim 10 where the region provides a passive electrical function.

13. The electronic device of claim 10 wherein the material includes  $Ba_{1+y}(Cd_{x+a}M_{1/3-x}Ta_{2/3})O_{3+z}$  wherein  $-0.1 < a < 0.1$ ,  $0 < x < 0.333$ ,  
15  $0.1 < y < 0.1$  and  $-0.1 < z < 0.1$ .

14. The electronic device of claim 10 wherein the material includes  $Ba_{1+y}(Cd_{1/3+a}Ta_{2/3})O_{3+z}$ , wherein  $-0.1 < a < 0.1$ ,  $0 < x < 0.333$ ,  
0.1 < y < 0.1 and -0.1 < z < 0.1.

20 15. The electronic device of claim 10 wherein the cadmium and tantalum are combined in a predetermined ratio.

25 16. The electronic device of claim 10 wherein the solid material further includes an element with valence 2.

17. The electronic device of claim 16 wherein the element is selected from a group of zinc and magnesium.

30 18. An optical device, comprising:

a region comprising a solid material including elements of barium, cadmium, and tantalum; and  
an input connected to the region.

19. The optical device of claim 18 wherein the cadmium and tantalum are combined in a predetermined ratio.

5 20. The optical device of claim 18 wherein the solid solution further includes an element with valence 2.

21. The optical device of claim 20 wherein the element is selected from a group of zinc and magnesium.

10 22. A method of making a ceramic dielectric material, comprising:

blending a mixture including barium, cadmium, and tantalum;

drying and heating the mixture; and

15 pressing the mixture into the ceramic dielectric material.

23. The method of claim 22 further including adding a sintering agent to the mixture.

20 24. The method of claim 22 further including adding an adhesive to the mixture before pressing the mixture into the ceramic dielectric material.

25 25. The method of claim 22 further including the step of making the ceramic dielectric material by solid state reaction synthesis.

30 26. The method of claim 22 further including the step of making the ceramic dielectric material by mechanical activation synthesis by mechanical alloying the mixture of barium oxide, cadmium oxide, and tantalum oxide.

27. The method of claim 25 further including the step of  
making the ceramic dielectric material by chemistry-based  
processing to synthesize the nanosized BCT including co-  
precipitation, sol-gel synthesis, alkoxide hydrolysis, and  
5 citrate routes.

28. A method of making a thin film dielectric material,  
comprising:

10 blending a mixture including barium, cadmium, and  
tantalum;

drying the mixture;

exposing the mixture to a laser; and

growing the thin film dielectric material on a substrate.

15 29. The method of claim 28 further including adding a  
sintering agent to the mixture.

30. The method of claim 28 further including the step of  
growing the thin film dielectric material on a substrate using  
20 sputtering, co-evaporation, molecular beam epitaxy, or chemical  
vapor deposition.